Quiet computing a reality?

written by dreamkatcha

The problem

Since embracing the holy grail of quiet computing I've lost touch with the mental anguish and exasperation associated with excessive PC generated noise. In an attempt to reacquaint myself with said torture and empathise with your plight I will be reporting live from a state of the art vertical wind tunnel. As well as simulating the free-fall skydiving experience I'll be looking at a number of ways to tranquillise your noisy beast of a computer, allowing you to once again appreciate the glorious sound of silence (or something not so far removed from it).

I'll begin by discussing the cheapest and easiest solutions available and gradually escalate the level of technical expertise required and cost involved so you can pitch your degree of dedication just right. You'll have to excuse me for shouting - I *am* competing with a 120 mph updraught. ;)

Your adversaries in the melee against PC noise pollution are primarily the fans required to keep your computer's components cool. Gone are the days when CPUs required so little cooling it was possible to dispense with fans completely. Today the progression of computer technology and specifically the competition between the two CPU manufacturing heavyweights, Intel and AMD, has resulted in the snowballing of chip speeds, and hence the intensity of active cooling demanded to keep these behemoths functioning. The faster the CPU, the faster the fan on your

heatsink has to spin to maintain a safe operating temperature. Inevitably, greater airflow results in a steep rise in the volume of white noise, and this leads to increased stress levels and lower productivity (being fragged by an online opponent in Unreal Tournament just doesn't bear thinking about, lol).

The first step - temperature monitoring

We've identified the problem, now let's look at possible solutions. You should start by finding out how hot your system is running so you'll know how much leeway for making adjustments you have. Providing your motherboard has built-in temperature monitoring sensors you can use Motherboard Monitor to pinpoint exactly how hot your hard drive(s), CPU, motherboard and graphics card are running at any given moment.

Furthermore, it can be used to set upper-temperature limits for each individual component and issue a warning or shut down your computer if these boundaries are crossed. If your CPU happens to be running at a cool 25 Celsius, for instance, it will be perfectly feasible to reduce the speed at which your heatsink's fan is spinning using a utility called Speedfan without causing any damage to your processor through overheating. You would do this by gradually decreasing the revolutions per minute (RPM) of the fan while monitoring the change in temperature.

If you have an older motherboard which isn't supported by the array of hardware monitoring software available you can instead use a small device called a Fanmate. As this is a hardware solution it will entail opening your computer case, but not to worry; this isn't one of the trickier modifications

discussed in this article. Fanmates are designed to form a bridge between your motherboard's fan connectors and the fans you intend to hush up allowing you to adjust the voltage delivered to them via a small knob, and hence alter their operating speed.

The hottest component in any PC

CPUs can generally run very hot and still be stable, but it isn't advisable to push them to their limits because this cuts short their lifespan significantly while increasing the likelihood of crashes. Ask people what they deem to be a safe operating temperature and you will get widely diverging opinions. Personally, I would use 45c as an upper limit - if the temperature rose above this level I would step up the airflow output a few notches to bring the temperature back down again.

An alternative, more radical view is that you can run your CPU at blisteringly hot temperatures as long as your system is stable because you are likely to upgrade your CPU long before it dies from overheating.

If the noise emitted by your system is now at an acceptable level you can down tools and enjoy the peace and quiet. If not, the next thing you might like to try is replacing the fans in your PC with higher quality, less audibly intrusive ones. Two models which admirably fulfil these criteria are the Panaflo FBA08A12L1A and the Papst 8412NGL.

If you can't manage to get hold of either of these, be on the lookout for fans which generate lots of airflow while keeping noise volume to a minimum. CFM and DB are the key acronyms you will need to identify in specifications pages. CFM stands for cubic feet per minute i.e. the volume of air fans are capable of pushing through a heatsink when

running at full speed, and DB is short for decibels, or in other words, the amplitude of undesirable background noise emitted.

Generally, CFM ratings increase uniformly with DB levels though the extent of the relationship depends on the quality of the fan in question. You should aim to find a fan which emits no more than 20 DB (the level of a whisper), obviously, the lower this figure the better providing sufficient airflow is rendered. Also, only seek out fans with a three-pin connector - the third pin is used to monitor and control RPM levels; such an attribute is therefore vital if you intend to manipulate them via software.

Fans come equipped with either ball or sleeve bearings. Ball bearings are considered to be the more reliable and long-lasting of the two types so elevate these to the top of your shopping list when given the choice to ensure long term quiet operation. Most heatsinks are supplied with small 60mm fans. These are very difficult to run quietly because they have to run faster than larger fans to provide the same airflow capacity. As a result, they produce a higher frequency, whiny, ear-piercing noise which can quickly grate on your nerves.

60mm fans can easily be forsaken for quieter, slower running 80mm ones providing you can find a way to hold them in place over your heatsink. You can achieve this using a Zalman fan bracket, a 60mm to 80mm adapter or any other creative customisation you care to devise (a spare fan grill attached directly to the heatsink can serve as an adaptor for example). Bear in mind that the fan doesn't necessarily have to be attached to the heatsink itself to deliver adequate cooling to your CPU.

Another source of fan noise can be traced back to the vibrations transmitted through the heatsink; you might like to attempt to absorb these using rubber grommets or whatever material you have to hand.

While we're on the subject of dampening vibrations, now would be an apt moment to briefly draw your attention to sound-absorbing material such as Dynamat. This can be cut to size and used to line your whole case to stop both airborne and structure-borne noise in its tracks. Not very effective in isolation, yet coupled with the other silencing techniques discussed in this article it can be the icing on the cake.

Sinking the heat

Next up; the heatsink. Ones with more intricate, folded fins are thought to be more efficient at carrying heat away from the processor. Silver is king when it comes to thermal conductivity but is rarely used because of the prohibitive costs involved. Copper is the next best thing for heat dissipation, followed by aluminium - other materials are to be avoided. Because surface area is directly proportional to the ability of a heatsink to dissipate heat, the bigger the better.

Among the best heatsinks on the market are the Thermalright SLK-900U, Zalman 6500B-Cu and certain Swiftech and Alphatech models. You will find more specific advice at reliable hardware review sites such as Anandtech.

To aid thermal conductivity between your CPU and heatsink it is imperative that you use high-quality thermal compound. Heatsinks often come complete with a thermal pad attached, though these are a poor substitute for thermal paste bought separately from specialist CPU cooling stores. Arctic Silver is

thought to be the most efficient thermal paste as it contains a higher proportion of micronized silver (a superb heat conductor) compared to competing brands.

The often-overlooked noisemaker

Your power supply is also a source of noise because it will almost certainly contain a fan, and unless you have specifically sought to buy a quiet model, this fan will not be especially low-key. Silencing a PSU can be achieved in one of two ways - you either modify the one you're currently using, or you replace it with a new one which provides minimal noise intrusion out-of-the-box. Replacing a PSU fan is straightforward enough, but can be lethal if you aren't careful since the coils contained within the enclosure can withhold their charge for up to several days after they are switched off.

If you don't have the patience to let a PSU discharge of its own accord, make sure you steer well clear of these coils - dead people can't use PCs, noisy or otherwise. Once you have opened the case you will need to clip the cables connecting the fan using a pair of wire cutters and attach the new fan using a soldering iron.

Some PSUs may contain proper connectors to allow you to switch the fan more easily, but it's unlikely that manufacturers would encourage this practise as it could lead to hardware (or wetware - that's you) damage. Few PSUs contain temperature monitoring sensors so it's difficult to know how hot they are running without sticking a probe in there manually. This is why PSU fans should be replaced like-for-like in terms of CFM ratings where possible.

The other option, buying a quiet by-design PSU, entails spending more than double the cost of your average bog-

standard model. The advantage is clear - there is no hassle involved and there is no risk to your health or the health of your computer. 'Intelligent' cooling brought about by temperature monitoring techniques is now a standard feature in better quality PSUs and this also helps to reduce noise. Two of the quietest PSUs currently available are made by Nexustek and Enermax.

For an astronomical fee, completely fanless (passive) PSUs can be purchased. Personally, I have found the claims of 'fanless' operation to be a blatant lie since such PSUs can overheat without the addition of an exhaust fan to expel hot air from your PC case. Since the PSU fan is designed to double up as an exhaust fan, it is a necessary evil for systems containing hot-running components such as fast hard drives or graphics cards so you may as well learn to live with it. If you bought a passive PSU and later discovered that an extra case fan was crucial to maintaining safe temperatures then you'd be right back at square one, only with a lot less money in your pocket.

Can't cool, won't cool? Buy a new CPU

The relationship between CPUs and heat is a simple one - CPUs which draw less power (measured in watts), generate less heat. Therefore buying a low-powered CPU provides a good foundation on which to build a quiet PC. VIA C3 processors fit the bill perfectly, the caveat, however, is that they pack a punch equivalent to that of a lethargic gnat so don't expect to be able to get good performance from modern 3D games.

AMD processors are half the price of equivalent Intel ones and offer excellent performance, though they run extremely hot and hence require faster spinning fans to keep them

cool. For this reason, they are best avoided if quiet operation is your top priority. Intel processors are far superior in this respect because they make use of more efficient heat spreading and dissipation techniques; for example, they are automatically underclocked (or throttled) in the event of heat surges to prevent meltdown.

If you are in the market for a new CPU, pay close attention to ones which use the lowest micron process available and which run at a lower voltage (the P4 pre-2.0 GHz Northwood range for instance - these can be identified by the presence of an 'A' tacked onto the clock speed in the product code). Very briefly, these are easier to cool because they draw less power from the PSU and hence generate less heat.

Something else you may like to research is 'underclocking'. This entails running a CPU at a lower clock speed than originally intended by the manufacturer by altering (reducing) its core voltage and clock speed in your BIOS. Modern processors are protected against tampering in this way so first have to be 'unlocked'.

It's also necessary that your motherboard supports 'undervolting'. Underclocking is clearly not for the speed freaks among us though is a very useful technique for silent PC enthusiasts to master as it results in a dramatic drop in processor generated heat and a reduction in the need for vigorous active cooling. Take the underclocking trick to extremes and you may even be able to go topless! (your heatsink that is, you know fanless... passive... oh forget it).

Data storage devices give you headaches too

Swapping a loud, screeching hard drive for a quieter model is a quick and easy way to reduce noise if you have cash to spare. The Barracuda V, made by Seagate, is currently the quietest drive on the market so should be riding high on the wish list of anyone wanting to subdue a droning PC (the Samsung SP1604N and Hitachi 180GXP are also highly regarded in muted PC circles).

Because the platters found in such drives are sandwiched between noise dampening materials they have a propensity to run hotter than your average hard drive. Even so, it is unlikely that additional active cooling will be necessary to keep the temperature within safe limits - that would defeat the purpose now wouldn't it.

Nearly all modern hard drives now support S.M.A.R.T (Self-Monitoring Analysis and Reporting Technology) making it possible to detect internal operating temperatures with tools such as Motherboard Monitor or HDD Temperature; my point being that if you install the right software it will give you a nudge to let you know if the temperature of your drive is creeping up to too high a level, giving you chance to implement counteractive measures.

To avoid noise and overheating issues you could buy a slower hard drive which spins at a relatively sedate 5,400 RPM (these days most drives are of the 7,200 RPM or higher variety). 2.5-inch drives designed for laptops also run cooler and quieter than average desktop hard drives so there's another alternative if cost is not a primary concern.

'Silent enclosures', as can be found at Quiet PC, can help to muffle the noise emitted by more sluggish hard drives though aren't recommended for higher RPM ones because they are apt to overheat with so little room to breathe. Hard drive vibrations won't help you in your quest for quiet and

can be marginalised using rubber grommets, or more exotic rubber suspension mechanisms (also available from Quiet PC).

If you have a creaky drive and aren't prepared to, or can't afford to replace it you could use RAMDisk to load your most commonly accessed data into RAM to quell its screaking. This will also help to accelerate access times.

Mobo gadgetry makes all the difference

For anyone intending to overhaul their PC from the ground up, keep in mind that not all motherboards are created equal in the tranquillity stakes. Aopen boards, for instance, have an integrated 'SilentTek' BIOS which utilises feedback from temperature sensing diodes to adjust CPU, exhaust and PSU fan speeds to maintain an optimum noise/heat balance. You can either specify fixed speed settings manually or let the BIOS handle these adjustments on-the-fly in response to fluctuating system temperatures ensuring that your PC is only ever as noisy is it has to be. Asus's Q-Fan smart cooling system aims to provide the same function yet isn't quite as sophisticated. Whichever motherboard you settle on make sure it doesn't have any additional fans attached to the Northbridge heatsink.

Noise, noise everywhere and not a chance to think

CD drives are notoriously noisy when spinning at full speed, however, this problem is easily obviated using CD emulation software such as Daemon Tools (covered in detail in the ISO tutorial and the ISO FAQ of this site). The premise is simple -

move the entire contents of your CDs to your hard drive and you won't need to access them via your CD drive at all. No spare hard drive space? Why not use a speed setting utility instead? Vibrations be gone!

Modern graphics cards shuffle data back and forth across their circuitry so quickly they demand a dedicated cooling system of their own - more often than not this comes in the form of a small whiny fan. If you can't live without a top of the range graphics card you're going to either have to learn to live with the noise generated by the fan or see if you can replace it with a passive GPU heatsink. Making this kind of modification will, of course, void your warranty and if anything should go wrong the manufacturer won't want to know. A less risky alternative is to buy a lower spec card to begin with, one which doesn't require active cooling. A good candidate is the Nvidia Geforce 4 MX440 as it offers excellent 3D performance without the need for air cooling.

Out of the box solutions

Now here's a novel idea; why not buy a complete system which was built from the ground up with the auditory bombardment of your poor neglected ears in mind? Surprisingly, the distracting nature of noise pollution isn't something that all that many manufacturers have given credence to in the past. The limited number of quiet systems which *are* available are outrageously overpriced and can only be found at highly specialist outlets or online stores. If money is no object, the following solutions may be of interest to you...

Apple - Sadly both of Apple's silent, fanless models have now been discontinued (the original G3 iMac and the G4 Cube). Modern Power Macs can be deafening though luckily

the latest LCD iMac is fairly subdued in the noise department.

ARM Systems - Manufacturers of the Stealth PC. Very quiet, but nothing revolutionary here. All the noise reduction techniques and modifications incorporated are equally available to the average end-user. Follow the advice in this article and you can achieve the same or better results (and for a lot less moolah). Marvellous for lazy technophobes. :p

Dell - For as long as I can remember Dell have gone to great lengths to construct unobtrusive computers. This has been accomplished through the use of enormous, passive heatsinks, ducting systems, large, slow-moving fans and high quality, vibration-free cases.

Mini-ITX - Mini-ITX is a form factor rather than a PC manufacturer though you can still buy complete systems from here (as well as the individual motherboards for those of you who like to mix and match). These boards are the smallest you can buy anywhere in the world so are perfect for building hi-fi or home theatre PCs. They come supplied with an embedded, low powered CPU, some of which can, in theory, be run passively. I say "in theory" because I bought the M6000 motherboard and beg to differ - temperatures rapidly escalated to 65c and the Northbridge heatsink became so hot it would burn my fingers. To keep my hard drive cool inside the diminutive case it became necessary to run the two tiny exhaust fans, which emitted quite a piercing screech. In the end, I returned it and got my money back. You would be wise to regard claims of fanless operation with scepticism to avoid disappointment.

NEC Powermate Eco - Comprises a fully functional computer built into an LCD monitor which uses a low powered Transmeta Crusoe processor that doesn't require active

cooling. The PSU is of the external laptop variety so no fans here either. Extortionate price for what you get and it's certainly no 3D gaming powerhouse - the main drawback of totally passive computers. Perfect for office environments with limited desk space.

Pandora Digital Media Systems - the (now discontinued) Tranquillity PC comes equipped with a cool running C3 processor so only needs sporadic air cooling during high-stress periods. Very quiet, though understandably not a high performer. Well suited for running office applications, web surfing, emailing etc. A new P4 version is currently under development. This will use a cool running 1.6 GHz CPU and a range of other quiet components. As with the Stealth PC, Do-It-Yourself and pocket the change.

Conclusion

Nose dives towards the ground as the wind tunnel fans are disabled. A bit of warning wouldn't have gone amiss, but no matter, I can always have reconstructive surgery later. :D Silencing my PC has been a frustrating and costly voyage of discovery, which has demanded many hours of web research and has entailed searching far and wide for quiet components. Has it all been worth it? You bet! Now I can barely hear my PC over the background noise I *choose* to listen to, in fact, it's no more intrusive than a purring kitten. That's progress for you, and just goes to show that it *is* possible to own a PC that is both powerful *and* quiet.

With a bit of patience and effort, you too can claw back your lost sanity and once again bask in the serenity of auditory nothingness. And if you think *I'm* obsessed, you ain't seen nothin' yet. I haven't even begun to touch upon water cooling, PC burying (yes, I said *burying*), DIY heatpipes,

cocoon-encased claustrophobic torture or computer relocation (without relocating yourself that is!).

Quiet is the new loud, enjoy the revolution!